

REMARKS

Claims 1-13 are pending in this application. Claims 5-13 have been withdrawn from consideration as being directed to a non-elected species of invention, and claims 1-4 have been rejected. Claim 1 has been revised to improve the form of the claim; no new matter has been added. Claim 1, as well as withdrawn claims 5, 8, 9, 11 and 12, are independent.

The Rejections Under 35 U.S.C. § 103(a)

Claims 1-3 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Appln. Publn. No. 2002/0012015 to Tsukada et al. in view of U.S. Patent No. 6,504,701 to Takamura et al. Applicant respectfully traverses this rejection, and submits the following arguments in support thereof.

Claim 1 describes an expendable container that includes an expendable tank configured to store an expendable and having a piezoelectric element attached thereto, a driving circuit configured to charge and discharge the piezoelectric element, a detection signal generation circuit configured to generate a detection signal including cycle information representing a cycle of an output voltage wave of the piezoelectric element after the driving circuit charges and discharges the piezoelectric element, and a control module configured to control at least one of an impedance of a discharge circuit through which the piezoelectric element discharges and a discharge time so as to be a certain level that reduces a noise element present in detecting the cycle information of the detection signal. The cycle information is available for determining whether a residual quantity of the expendable is greater than a preset

level, and the control module is capable of varying a discharge characteristic of the piezoelectric element.

In particular, it will be appreciated that the claimed invention is directed to a configuration where the cycle information of remaining vibration of a piezoelectric element after charge and discharge is usable in determining whether the residual quantity of stored expendable is greater than a present level, and this configuration is characteristically capable of varying the discharge characteristic of the piezoelectric element. The piezoelectric element is used as a sensor in a detection process. By way of non-limiting example, a driving circuit as claimed will be particularly clear keeping in mind the charge pump circuit 250, resistor R1, transistors Tr1 and Tr2, and discharge time constant adjustment resistive circuit Rs, described at page 18 of the specification. Likewise, the claimed detection signal generation circuit will be clear in view of amplifier 232 and pulse counter 235, also described at page 18 of the specification. Also, the control module will be clear in view of quantity detection circuit 230, again, mentioned at page 18 of the specification.

The Office Action **admits** that Tsukada does not expressly teach all the features of the claimed invention, and, in particular, fails to suggest the feature of "the control module being capable of varying a discharge characteristic of the piezoelectric element" as recited in claim 1 (Office Action, pg. 3).

Although the Office Action looks to Takamura to provide teachings for the feature lacking in Tsukada, Takamura, as explained below, fails even to suggest the claim features that distinguish over Tsukada.

Takamura teaches a capacitive element drive device for a piezoelectric member of an ink jet head. Takamura discloses a configuration that varies the charge characteristic of a

piezoelectric element when the piezoelectric element is activated as an actuator, rather than a detection technique. Takamura is not specifically concerned with structure for detecting an amount of expendable, in the manner claimed. Accordingly, it will be understood that while Takamura varies the charge characteristic of a piezoelectric element, Takamura does so when the piezoelectric element is activated as an actuator (to eject ink), rather than as a detection technique, in the manner claimed. It must be kept in mind that a detection technique and an activation technique are completely different from each other, and teachings regarding one technique cannot necessarily be applied to the other. Thus, although Takamura teaches structure for driving the piezoelectric element of an ink jet print head, one skilled in the art only would not be led to apply those teachings to a sensor for measuring expendable material, as arguably taught by Tsukada. Rather, one skilled in the art would modify Tsukada's printhead structure shown in Fig. 18 and described at page 15 for ejecting ink as Takamura teaches.

Although the Office Action, at page 6, suggests Takamura's circuit could be applied to Tsukada to lead to the claimed invention, Applicant respectfully disagrees. One skilled in the art applying Takamura's circuitry to Tsukada would incorporate Takamura's circuitry into Tsukada in the same role that the circuitry has in Takamura, which is as part of a circuit for actuating the piezo element to eject ink (not to detect an amount of expendable). To repurpose Takamura's driving circuitry to instead operate with a detector would be proceeding away from the clear teachings of Takamura.

Put another way, a detection technique, as claimed, is entirely different from an activation technique, as Takamura teaches, and circuit elements used for one technique would not be applied to the other without a clear reason to do so.

This rejection is further traversed on grounds that the Office Action, in its justification for combining Tsukada and Takamura, reaches the same conclusion that one skilled in the art would modify Tsukada's driving structure for ink discharge as Takamura teaches (not sensor structure, as claimed). The Office Action states at page 3:

Takamura et al. discloses a CMOS drive circuit that drives a piezoelectric member as a capacitive element in an inkjet head. The discharge operation of the piezoelectric is controlled by the timing set by the circuit [Abstract]. Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify the Tsukada et al. invention to include means for controlling a discharge time of the piezoelectric element as taught by Takamura et al. for the purpose of setting a proper value at which desired operating speed, high reliability and low power consumption are achieved.

So the Office Action implicitly recognizes that, if combined, the references teach modifying Tsukada's printing structure (not structure for detecting an amount of expendable) in the manner of Takamura.

In any event, although the Office Action looks to Takamura to remedy Tsukada's admitted shortcomings, Takamura does not contain any such remedial teachings -- all of Takamura's teachings relate to the circuitry for driving a piezoelectric element used to eject ink, not to a sensor for detecting an amount of expendable.

As a result, when Tsukada and Takamura are combined, that does not lead to the claimed invention.

It noted that although the Amendment filed on October 16, 2007, presented several reasons why the previous Office Action of July 16, 2007, improperly combined Tsukada and Takamura, the Office Action does not comment upon any of those grounds of traverse. Applicant therefore respectfully incorporates those grounds of traverse herein, and submits that because the current Office Action does not refute any of those earlier grounds of traverse, the

combination of Tsukada and Takamura remains improper for the reasons set out in the October 16 Amendment, and so for this reason alone, the rejection of claims 1-3 must be withdrawn.

The remaining rejected claims, claims 2 and 3, both depend from and so incorporate by reference all the features of claim 1, including those features which have been shown to avoid the cited art. These claims therefore patentably distinguish over Tsukada and Takamura at least for the same reasons claim 1.

For all the foregoing reasons, favorable reconsideration and withdrawal of this rejection are respectfully requested.

Claim 4 has been rejected under 35 U.S.C. § 103(a) as being unpatentable over Tsukada in view of Takamura and further in view of U.S. patent no. 4,714,935 to Yamamoto et al. Applicant respectfully traverses this rejection, and submits the following arguments in support thereof.

Claim 4 depends from, and so incorporates by reference all the features of claim 1, including those features just shown to distinguish over Tsukada and Takamura.

The Office Action looks to Yamamoto to teach features of claim 4 which the Office Action admits are not found in Tsukada or Takamura. Regardless of whether that is correct, Yamamoto only is concerned with structures for activating the piezoelectric driving elements of an ink jet printhead to print, not structures for operating detectors for measuring the amount of expendable. Yamamoto therefore suffers from the same shortcomings as Takamura (all the teachings only apply to the driving of piezo ejection elements, not to an expendable detector) and so fails to remedy the above-mentioned deficiencies of Tsukada and Takamura.

Accordingly, claim 4 patentably distinguishes over the cited art, and so favorable consideration and withdrawal of this rejection are respectfully requested.

CONCLUSION

The cited Tsukada reference is commonly assigned along with the present application. To the extent this response discusses Tsukada, such discussion involves the general teachings of the references, and should not necessarily be construed to limit the scope of the claims of that reference, or its counterparts. If Tsukada is characterized as teaching a particular feature or mode of operation, the claims of the reference and its counterparts should not necessarily be construed to require that feature or mode of operation unless the feature or mode of operation is specifically recited in the claims. In this regard, it should be noted that the claims of a patent are not necessarily limited to embodiments disclosed, and that limitations in the specification are not necessarily to be imported into the claims. Also, an inventor need not foresee all uses for their invention.

Applicant respectfully submits that all outstanding rejections have been addressed and are now either overcome or are moot. Applicant further submits that all claims pending in this application are patentable over the prior art. Favorable reconsideration and withdrawal of those rejections and prompt allowance of this application are respectfully requested.

Other than the extension fee authorized in the accompanying Petition for Extension of Time, no fees are presently believed to be due in connection with the filing of this paper. If, however, any additional fees are deemed to be now or hereafter due in connection with this application, the Commissioner is authorized to charge all such fees to Deposit Account No. 19-4709.

In the event that there are any questions, or should additional information be required, please contact applicant's attorney at the number listed below.

Respectfully submitted,

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